

CLAIMS

WHAT IS CLAIMED IS:

- 1 1. A chelator particle comprising: a particle, a plurality of chelator compounds
2 attached to at least the surface thereof, and optionally a relatively inert spacer disposed
3 therebetween.
- 1 2. The chelator particle of claim 1, wherein the particle comprises a metal oxide
2 abrasive, iron oxide, a doped metal oxide, a metal nitride particle, a metal oxynitride
3 particle, a metallic particle, a metal alloy particle, an organometallic particle, a polymer
4 particle, a buckeyball, a buckeybowl, a carbon nanotube, a carbon black particle, activated
5 carbon, a charcoal particle, a diamond particle, montmorillonite, an inorganically- and/or
6 organically- modified clay, or a combination thereof.
- 1 3. The chelator particle of claim 1, wherein the particle has a net negative zeta potential
2 at least before attachment.
- 1 4. The chelator particle of claim 3, wherein the net negative zeta potential remains
2 negative even after attachment of the plurality of chelator compounds.
- 1 5. The chelator particle of claim 1, wherein the particle has an average particle size
2 from about 1 nm to about 4000 nm.
- 1 6. The chelator particle of claim 1, wherein the plurality of chelator compounds
2 attached to the particle possess functional groups comprising hydroxyls, carboxylic acids,
3 amines, amides, imines, imides, mercaptans, sulfonic acids, hydroxamic acids, carbonyl
4 groups, esters, ethers, ureas, cyano groups, nitro groups, phosphonic acids, phosphonates,
5 carbonates, inorganic salts thereof, or a combination thereof, and wherein at least a portion
6 of the functional groups are no further than about 7Å from another functional group.
- 1 7. The chelator particle of claim 1, wherein each chelator compound, before being
2 attached to the particle, possesses at least three functional groups comprising hydroxyls,
3 carboxylic acids, amines, amides, imines, imides, mercaptans, sulfonic acids, hydroxamic
4 acids, carbonyl groups, esters, ethers, ureas, cyano groups, nitro groups, phosphonic acids,
5 phosphonates, carbonates, inorganic salts thereof, or a combinations thereof.

- 1 8. The chelator particle of claim 1, wherein the plurality of chelator compounds
2 comprises one or more of the following oligomeric and/or (co)polymeric chelators:
3 poly(styrene sulfonic acid), poly(vinyl sulfonic acid), poly(acrylic acid), poly(methacrylic
4 acid), a poly(acrylate), a poly(methacrylate), a poly(alkacrylate), poly(maleic acid),
5 poly(vinyl acetate), poly(vinyl alcohol), poly(acrylamide), poly(cyanoacrylate), a cellulosic
6 material, or a mixture or copolymer thereof.
- 1 9. The chelator particle of claim 1, wherein the plurality of chelator compounds does
2 not comprise poly(styrene sulfonic acid), poly(vinyl sulfonic acid), poly(acrylic acid),
3 poly(methacrylic acid), a poly(acrylate), a poly(methacrylate), a poly(alkacrylate),
4 poly(maleic acid), poly(vinyl acetate), poly(vinyl alcohol), or a mixture or copolymer
5 thereof.
- 1 10. The chelator particle of claim 1, wherein the majority of the chelator compounds are
2 attached to the particle, optionally being attached to the spacer and the spacer being attached
3 to the particle, by a covalent chemical bond.
- 1 11. The chelator particle of claim 1, wherein the optional spacer is present and
2 comprises at least about 10 carbon atom linkages.
- 1 12. The chelator particle of claim 11, wherein the spacer is oligomeric or (co)polymeric
2 and comprises a polysiloxane; a polyolefin; a polyacrylate; a polyalkacrylate; a
3 polycarbonate; a perfluorinated polymer; a halogenated polymer; a polyimide; a polyimine;
4 a conjugated (co)polymer; a polyketone; a polyether; a polyurethane; a polylactide; or a
5 copolymer or combination thereof.
- 1 13. A chelator particle that is insoluble in water comprising:
2 an oligomer and/or (co)polymer having a plurality of pendant functional groups
3 attached thereto,
4 said functional groups comprising hydroxyls, carboxylic acids, amines, amides,
5 imines, imides, mercaptans, sulfonic acids, hydroxamic acids, carbonyl groups, esters,
6 ethers, ureas, cyano groups, nitro groups, phosphonic acids, phosphonates, carbonates,
7 inorganic salts thereof, or a combination thereof,
8 wherein at least a portion of the functional groups are no further than about 7Å from
9 another functional group, and

10 wherein at least a portion of the pendant functional groups are present at the surface
11 of the particle when the particle is present in a solution containing water.

1 14. A polishing, etching, and/or residue removing slurry comprising:
2 a polishing accelerator;
3 a diluent;
4 optionally an abrasive material; and
5 a plurality of chelating particles of claim 1 that are insoluble in the diluent.

1 15. A chemical mechanical polishing slurry comprising:
2 an oxidizer;
3 a diluent;
4 optionally an abrasive material; and
5 a plurality of chelating particles of claim 13.

1 16. A method of chemically mechanically polishing, etching, or removing residue from
2 a substrate comprising the steps of:
3 providing a slurry according to claim 14;
4 providing a substrate comprising a metal-containing material on a surface; and
5 movably contacting the slurry with the surface under conditions where a portion of
6 the metal-containing material is removed, wherein the chelating particles chelate at least a
7 fraction of the metal-containing material removed from the substrate surface.

1 17. A method of chemically mechanically polishing a substrate comprising the steps of:
2 providing a slurry according to claim 14, wherein the slurry comprises an abrasive
3 material;
4 providing a substrate having a surface comprising a metal-containing material; and
5 movably contacting the slurry with the surface under conditions where a portion of
6 the metal-containing substrate is removed, wherein the chelating particles chelate at least a
7 fraction of the metal-containing material removed from the substrate surface.

1 18. A method of chemically mechanically polishing a substrate comprising the steps of:
2 providing a slurry according to claim 15;
3 providing a substrate having a surface comprising a metal-containing material; and
4 movably contacting the slurry with the surface under conditions where a portion of

5 the metal-containing material is removed, wherein the chelating particles chelate at least a
6 fraction of the metal-containing material removed from the substrate surface.

7 19. The method of claim 18 wherein the slurry comprises an abrasive material different
8 than the chelating particles.

1 20. A method of chemically mechanically polishing a substrate comprising the steps of:
2 providing a slurry comprising an oxidizer, a diluent, optionally an abrasive material,
3 and metal-absorbent clay material;
4 providing a substrate having a surface comprising a metal, a metal-containing
5 material, or both; and
6 movably contacting the slurry with the surface under conditions where a portion of
7 the metal, metal-containing material, or both is removed, wherein the metal-absorbent clay
8 material absorbs at least a fraction of the metal and/or metal-containing material removed
9 from the substrate surface.
10

11 21. The method of claim 20 wherein the slurry comprises an abrasive material different
12 than the metal-absorbent clay material.